Cutting pig

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Equivalents:

Abstract

A self-propelled fluid jot cutter for pipes for the removal of tree roots and other obstructions or for cutting liners comprises at least one motor 102 to move the cutter along the pipe and to rotate a cutting head 114 about at least one axis eg. longitudinal axis X. The cutting head may be drawn by a separate motor 112 as shown or by the same motor (eg. 130, Fig 2 not shown) propelling the cutter or pig. The head 114 may employ water and/or abrasive and may have an adjustable angle M to axis X. The pig may carry a T.V. camera (eg. 116, Fig. 2). A shaft/gearing arrangement (Fig. 3 not shown) may be provided to allow the cutting head (eg. 140) to rotate about the X-axis to position opposite a lateral and then rotate about an axis Y transverse to axis X to out a liner across the lateral. 

D scription

Device for Fluidic Cutting within Conduit
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The invention relates to a device of the kind which is inserted into conduits and bears a jet head provided with at least one nozzle through which a fluid, usually water, is sprayed at high velocity to cut through obstructions within the conduit. Such obstructions include three roots and pieces of concrete from badly-formed pipe-work.

Hitherto such known devices have consisted of a sled mounting a motor for rotation of the jet head said known devices being winched through conduits on a cable between two access points. To cut away obstructions in pipes joining the conduit in which the device is located, it has been known to provide a laterally facing jet rotating about an axis normal to the direction of motion of the device through the main conduit. Such previous devices have been bulky and not convenient to use in narrow conduits.

The present invention seeks to provide an improved device of this kind.

The present invention provides a device for fluidic cutting within conduits comprising a chassis, first drive means mounted on the chassis and operable to move the device along a conduit, a jet head mounted for rotation on the chassis about an axis parallel to the direction of travel of the device, second drive means operable to at least partially rotate said jet head about said axis.

Preferably the device is also provided with third drive means operable to rotate said jet head about an axis substantially normal to the direction of motion of the device along a conduit.

Desirably the first drive means comprises a motor driving at least one wheel via a first remotely operable clutch.

The second drive means may comprise said motor driving said jet head via a second remotely operable clutch.

Alternatively, the first and second drive means may comprise respective motors driving said at least one wheel and said jet head respectively via first and second remotely operable clutches. The second and third drive means may comprise a motor operable to drive said jet head about said normal axis via a third remotely operable clutch and to drive said jet head about said parallel axis via said second remotely operable clutch.

Embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:
Fig 1. is a schematic plan view of a first device according to the invention.

Fig 2. is schematic plan view partially broken away of a second device according to the invention.

Fig 3. is a schematic plan view of a jet head alternative to a jet head fitted to the device of 2 (shown partially broken away).

Fig 4. is a schematic side view on a larger scale of the second device (shown foreshortened) fitted with a jet head similar to that shown in Fig 3.

Fig. 1 shows a device comprising a chassis 100 mounting a motor 102 operable via a gearbox 103, a clutch 104, shaft 105, and a bevel gear arrangement 106 to drive an axle 108 mounting ground engaging wheels 110. The motor 102 is powered by an electrical current supplied to the device through an umbilical cable (not shown). The clutch is used when disengaged to interrupt movement of the device through a conduit. A second electric motor 112 drives a jet head 114, via a second gearbox 113 a shaft 111 and a second clutch 115; the jet head being rotatable through more than 3600about an axis X parallel to the direction of motion of the device when under the influence of the motor 102.Since the device is used in conduits no steering ability of the device is necessary, the curved walls of most conduits acting to steer the device should it have a tendency to try to 'climb' the conduit walls, especially when negotiating slight bends

in conduits. In most applications access points are provided at bends and intersections in the conduits.

Wheels 120 are driven from axle 108 via a gear train (not shown) and a layshaft 122 (shown schematically). A closed circuit television camera (see Fig.2) is mounted on a top cover (see Fig.2) of the device its wide angle lens pointing forward to view cutting motion of the jet head 114 about axis X. The chassis 100 is of box construction with walls provided with tapped holes 101 for securement of the cover by screws.

In operation of the device shown in Fig.1 the device is inserted into a conduit to be worked on at a convenient access point as close as possible to a work point in the conduit where the device is to commence cutting work. The closed circuit television camera whose signal is fed to a monitor at a convenient remote location via a second umbilical cable (not shown) is switched on. The motor 102 is switched on and clutch 104 locked so that motor 102 drives wheels 110. When the device reaches the work point, a pressurised supply of water supplied to the device through an umbilical hose (not shown) is switched on and a jet issues from a nozzle 118 of the jet head 114.

The nozzle is arranged to direct the water generally forwardly but a little outwardly at an angle M to the axis X. Tree roots and the like obstructions at the cutting point are cut away by the water jet which is rotated about axis X rotating the jet head 114 relative to chassis 100 by motor 112 via clutch 115 to follow the conduit curvature.

The device is dimensioned such that axis X lies as close to the centre line of the conduit as possible so that the jet nozzle 118 can follow the periphery of the conduit in a smooth manner. Wheels 110 and wheels 120 in different sets of sizes may be used to enable adjustment of the position of the device in conduits of different diameters. For larger diameter conduits the jet nozzle 118 must be mounted on an extension arm so that the jet is delivered close to the wall of the conduits. The nozzle 118 is adjustable to alter angle M.

It if often the case that obstructions such as tree roots only occur in certain circumferential regions of the conduit and so full rotation of the jet head 114 is often not necessary.

The clutches 104 and 105 could be omitted but they are desirable to enable, respectively, the wheels 110 to free wheel when the device is to be removed from the conduit by a rope or other means, and the jet head 114 to be prepositioned easily at a particular angular displacement from top centre before the device is placed in a conduit, and for ease of maintenance. Fig.2 shows a device which has a single motor 130. Counterparts in the device of
Fig. 2 of the parts of the device shown in Fig.l have been given the same reference numerals.

The motor 130 is operable to drive either the wheels 110 via gearbox 103 and clutch 104, or to drive the jet head 114 via gearbox 113 and clutch 115 (or possibly both though this is unlikely to be required). Thus motor 130 fulfils the functions of both motor 102 and motor 112, giving greater compactness of the device. Clutches 104 and 115 are necessary in the device of Fig.2.

A cover 124 (shown partially removed) mounts a closed circuit television camera 116 on its upper surface, the camera having a lens 117 pointing towards the jet head 114 (shown partially broken away on Fig. 2). A cover (not shown) similar to that shown in Fig.2 of slightly different shape is provided for the device of Fig.1 and also mounts a camera 116.

Fig. 3 shows a more complex jet head 140 fitted to a device as shown in Fig. 2 (partially broken away) but suitable also for use with the device of Fig 1.

Shaft 111 is driven by motor 130 (not shown) and is coupled to a further shaft 142 by a clutch 144. The latter is arranged such that when it is engaged the jet head 140 as a whole turns with said shaft enabling the angular positioning of the jet nozzles 118 about axis X against a lateral conduit to be cut. When the lateral position is reached clutch 144 is disengaged and shaft 111 turns shaft 142 alone, friction between the casing 146 of the jet head 140 and the chassis 100 preventing movement of the jet head 140 relative to chassis 100. Shaft 142 turns the jet nozzles about an axis Y through the agency of bevel gears (not shown).

Fig.4 shows a jet head 140 having wider spaced arms 148 than those in the device of Fig.3 to correspond to a lateral conduit 150

tC#r;L of larger diameter than aF for which the jet nozzles shown in Fig.3 are intended.

The devices according to the invention may have instead of or as well as electric motors 102, 112 and 130, fluid powered motors or any other suitable type.

The closed circuit TV camera has been omitted from Fig.4.

The turn nozzles shown in Figs.3 and 4 may be replaced by a single nozzle.

Whilst in the device described water is the cutting medium any suitable fluid medium may be used such as 'fluidised' sand or other abrasive or a combination of water and sand or other abrasive.

The sand/abrasive would be supplied through a hose (not shown) in known manner.

Claims

Claims.

1. A device for fluidic cutting within conduits comprising a chassis, first drive means mounted on the chassis operable to move the device along a conduit, a jet head mounted for rotation on the chassis about an axis parallel to the direction of travel of the device, second drive means operable to at least partially rotate said jet head about said axis.

2. A device as claimed in Claim 1 in which the device is also provided with third drive means operable to rotate said jet head about an axis substantially normal to the direction of travel of the device.

3. A device as claimed in any preceding claim in which the first drive means comprises a motor driving at least one wheel via a first remotely operable clutch.

4. A device as claimed in Claim 3 which the second drive means comprises said motor driving said jet head via a second remotely operable clutch.

5. A device as claimed in Claim 1 or Claim 2 in which the first and second drive means comprise respective motors driving said at least one wheel and said jet head respectively via first and second remotely operable clutches.

6. A device as claimed in Claim 4 or Claim 5 as appended to
Claim 2 in which the second and third drive means comprise a motor operable to drive said jet head about said normal axis via a third remotely operable clutch and to drive said jet head about said parallel axis via said second remotely operable clutch.

7. A device substantially as hereinbefore described with reference to Fig 1, Fig 2, Fig 3 or Fig 4 of the accompanying drawings.

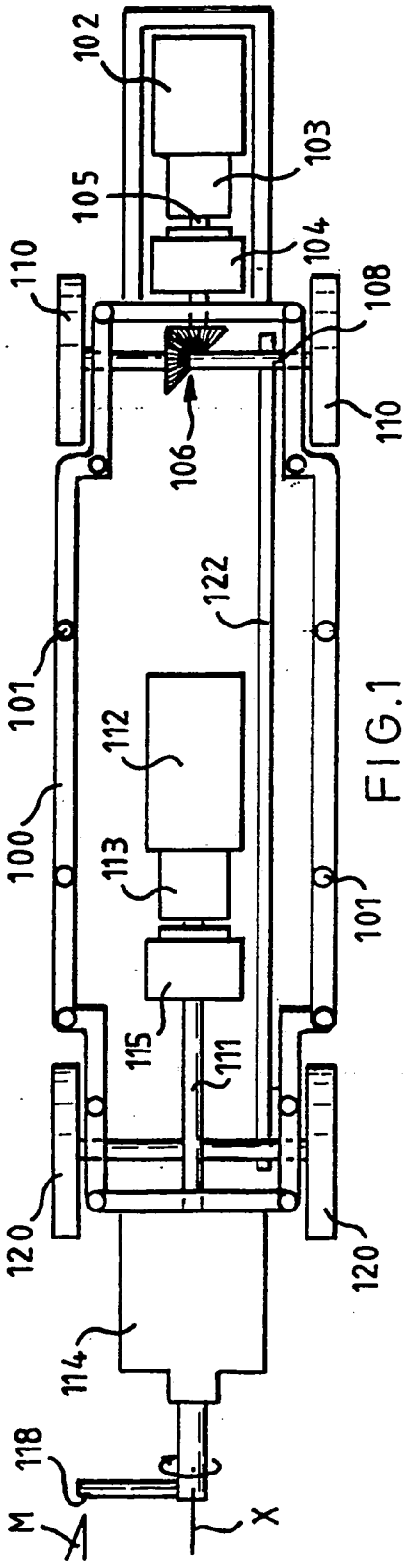
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FIG.1

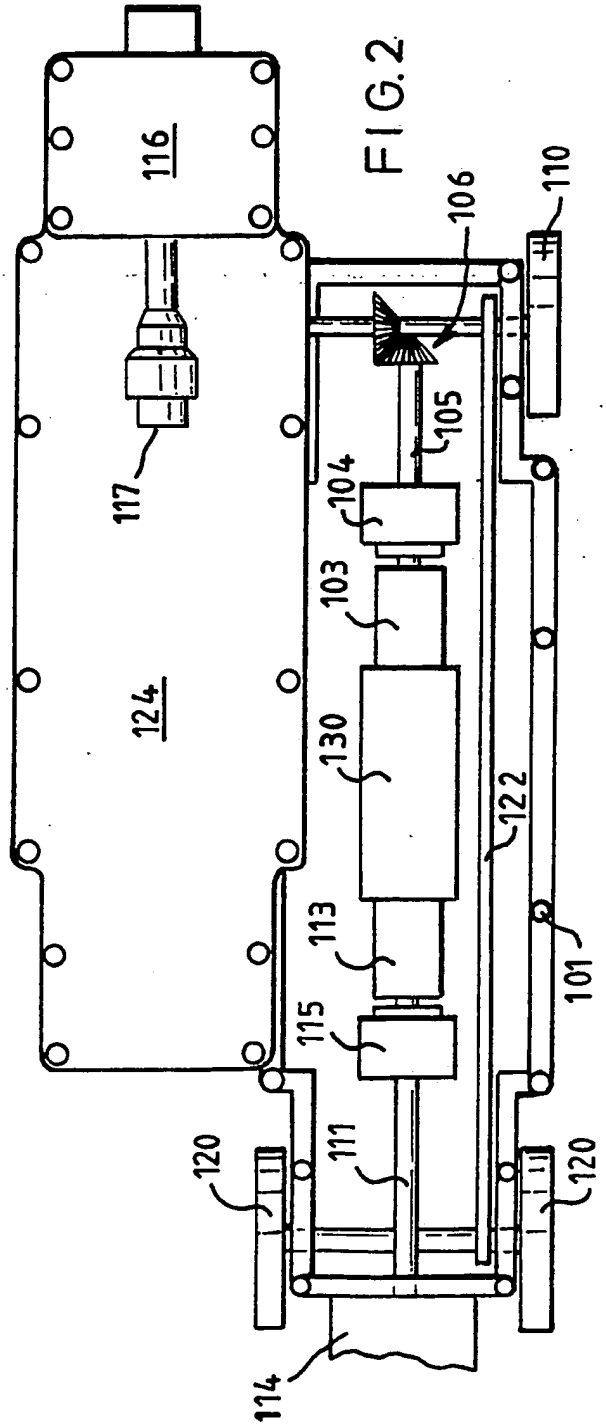
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FIG.2

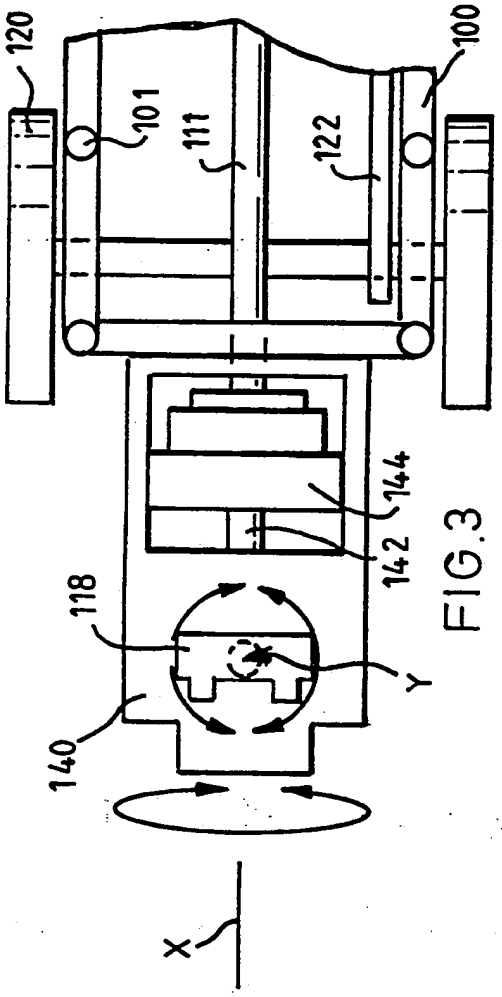

FIG.3

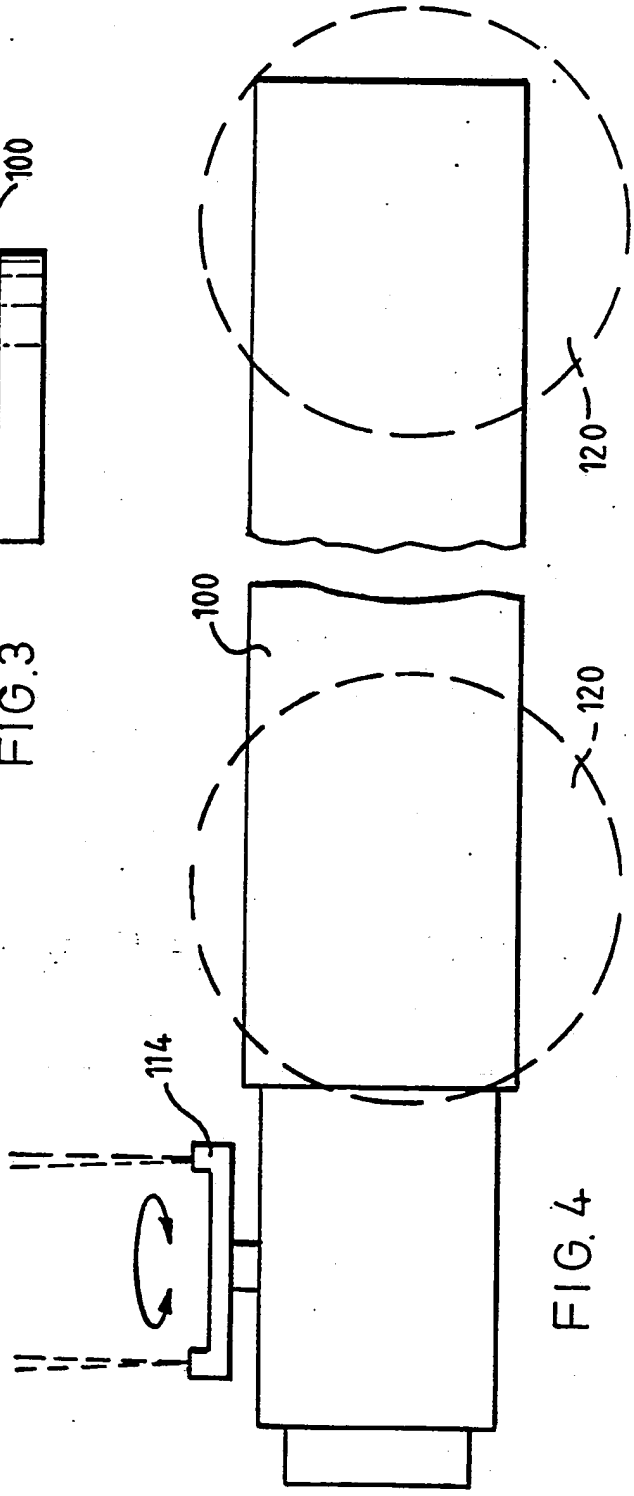

FIG.4